

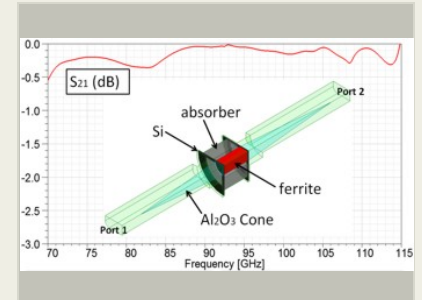
## Low-Loss Ferrite Components for NASA Missions, Phase I

Completed Technology Project (2015 - 2015)



## Project Introduction

Ferrite based isolators and circulators have been successfully demonstrated at microwave, millimeter-wave and submillimeter-wave frequencies. These components are nonreciprocal and thus highly useful for controlling standing waves and directing signal flow in frequency multiplier cascades, heterodyne, radar, radiometer, and other systems commonly deployed by NASA. However, at the higher frequencies the performance is degraded in terms of bandwidth and loss which severely limits their usefulness. Although there is a demonstrable need for these components, there are relatively few vendors. Most of the commercially available components were developed more than forty years ago and there has been little effort at modernization. Recent advances reported in the literature suggest that the loss in Faraday rotation isolators can be significantly reduced. Using modern electromagnetic simulation tools, we propose to design millimeter-wave and sub-millimeter-wave ferrite components that exhibit significantly reduced loss, and improved power handling and bandwidth. Initial work on the development of a W-band isolator is underway. Ferrite cores have been manufactured and the impedance matching structures have been designed. We plan to demonstrate the effectiveness of our approach within the six month timeframe of the SBIR Phase I program. We have also successfully modeled Y-junction circulators that accurately predict performance similar to those available in the commercial market and are now working on several approaches to increase the bandwidth of these devices. A preliminary design operating at 160 GHz has been completed. In the Phase I program, the design will be refined, built and tested. Beyond Phase I, our goal is to develop a full line of ferrite components operating from 75 GHz to over 320 GHz with significantly improved performance over the current state-of-the-art.



Low-Loss Ferrite Components for NASA Missions, Phase I

## Table of Contents

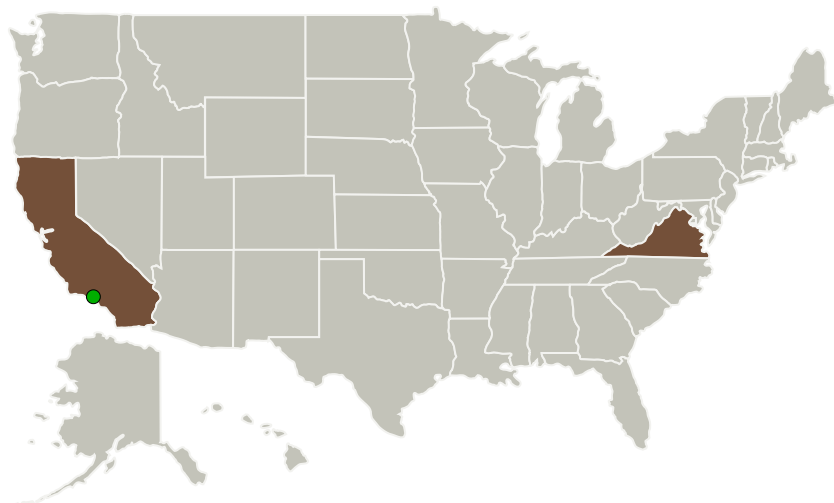
Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Images	3
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

## Low-Loss Ferrite Components for NASA Missions, Phase I

Completed Technology Project (2015 - 2015)



## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Micro Harmonics Corporation	Lead Organization	Industry	Fincastle, Virginia
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

## Primary U.S. Work Locations

California	Virginia
------------	----------

## Project Transitions

**June 2015:** Project Start**December 2015:** Closed out**Closeout Summary:** Low-Loss Ferrite Components for NASA Missions, Phase I Project Image**Closeout Documentation:**

- Final Summary Chart Image(<https://techport.nasa.gov/file/139060>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Micro Harmonics Corporation

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

David W Porterfield

**Co-Investigator:**

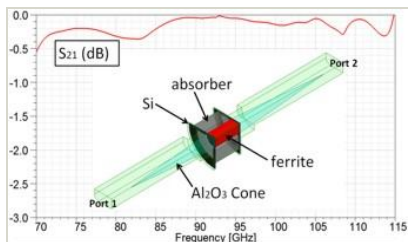
David M Porterfield

# Low-Loss Ferrite Components for NASA Missions, Phase I

Completed Technology Project (2015 - 2015)



## Images



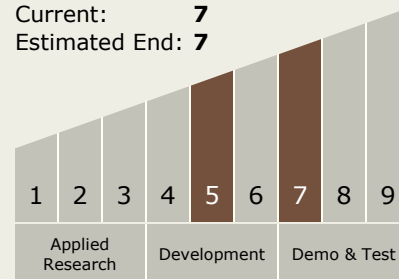
### Briefing Chart Image

Low-Loss Ferrite Components for NASA Missions, Phase I

(<https://techport.nasa.gov/image/133464>)

## Technology Maturity (TRL)

Start: **5**  
Current: **7**  
Estimated End: **7**



## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System